DYNAMETERS™

Series DMTF

Clamp-on & Insertion Transit

Time Ultrasonic Flow Meters

Operation & Maintenance Manual

REV 1/07

MICROVIEW

Instrument • Medical • Tool

Table of Contents

Part 1 – Introduction 4

1.1 GENERAL 4
1.2 PRINCIPLE OF MEASUREMENT 4
1.3 APPLICATIONS 5
1.4 FEATURES 5
1.5 SPECIFICATIONS 6
1.6 MODEL SELECTION 7

Part 2 - Transducer Installation 10

2.0 GENERAL 10
2.1 MOUNTING LOCATION 10
2.2 TRANSDUCER SPACING 12
2.3 TRANSDUCER MOUNTING 15
2.4 TRANSDUCER MOUNTING INSPECTION AND COUPLANT APPLICATION 21
2.4.1 Transducer Mounting Inspection *21*
2.4.2 Couplant Application *21*

Part 3 - Instructions on Installation, ... 22

Connection and Operation 22

3.1 TRANSMITTER INSTALLATION 22
3.2 TRANSDUCER INPUT CONNECTIONS 23
3.3 TRANSMITTER POWER SUPPLY AND OUTPUT CONNECTIONS 24
3.4 KEYPAD CONFIGURATION 26
3.4.1 Keypad functions *26*
3.4.2 Keypad Operation *27*
3.4.3 DMTF Window Descriptions *28*
3.4.4 Pipe Parameter Entry Shortcuts *29*

Part 4 - Windows Display Explanations..... 31

Part 5 - How to Use Menu Functions 38

5.1 HOW TO JUDGE WHETHER THE INSTRUMENT WORKS PROPERLY 38

5.2 How to Judge the Liquid Flowing Direction 38
5.3 How to Reset the Instrument into Default Settings 38
5.4 How to Stabilise the Flow 38
5.5 How to Use the Zero-Cutoff Function 38
5.6 How to Setup a Zero Flow Calibration 39
5.7 How to Use Scale Factor 39
5.8 How to Use the Operation Locker 40
5.9 How to Use the 4-20 mA Output 40
5.10 How to Use the Flow Rate Frequency Output 41
5.11 Totaliser Pulse Output 41
5.12 How to Set the Date and Timer 42
5.13 On/Off Flow Totalisers 42
5.14 Measurement Unit Selections 42
5.15 LCD Backlit Options 43
5.16 Use Menu Windows for Transducer Mounting Inspection 43
5.16.1 Signal Strength 43
5.16.2 Signal Quality (Q Value) 43
5.16.3 Total Time and Delta Time 43
5.16.4 Transit Time Ratio 44
5.16.5 Warnings 44

Part 6 - Troubleshooting and Frequently Asked Questions ... 46

6.1 Troubleshooting 46
6.2 Frequently Asked Questions (FAQs) and Answers 48

Part 7 – Limited Warranty and Service 51

7.1 Limited Warranty and Disclaimer 51
7.2 General Terms and Service 52

Part 1 – Introduction

1.1 General

Engineers and technicians of fluid process management expect to achieve flow measurement on the non-invasive pipeline in a reliable and accurate method. DMTF series ultrasonic flow meter was introduced to the world to satisfy this demand. It provides a measuring system with high accuracy, versatility, reliability, and ease of operation. Although the original design is primarily focused on cleaner liquids, this kind of flow meter can also reliably measure liquids containing moderate amounts of suspended solids or aeration. DMTF series ultrasonic flow meter undertakes the long- or short-term flow measurement surveys on full-pipe liquid systems. It is an ideal to verify flow calibration for these permanently mounted flow meters.

1.2 Principle of Measurement

The DMTF series ultrasonic flow meter is designed to measure the fluid velocity of liquid within a closed pipe. The transducers are a non-invasive, clamp-on type, which provides benefits of non-fouling operation and ease of installation.

The DMTF series transit time flow meter utilises two transducers that function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of a closed pipe at a specific distance from each other. The transducers can be mounted in V-mode where the sound transverses the pipe twice, or W-mode where the sound transverses the pipe four times, or in Z-mode where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. This selection of mounting configurations depends on both pipe and liquid characteristics. The flow meter operates by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers and measuring the time interval that it takes sound to travel between the two transducers. The difference in the time interval is directly related to the velocity of the liquid in the pipe, as shown in Figure 1.

$$V_f = Kdt/TL$$

Where:

V_f Liquid velocity

K Constant

dt Difference in time of flight through the following

TL Average Transit Time

1.3 Applications

For Liquids

1.) Water, sewage (with low particle content) and sea water
2.) Water supply and drainage water
3.) Process liquids; Liquors
4.) Milk, Yoghourt milk
5.) Gasoline, Kerosene and Diesel oil

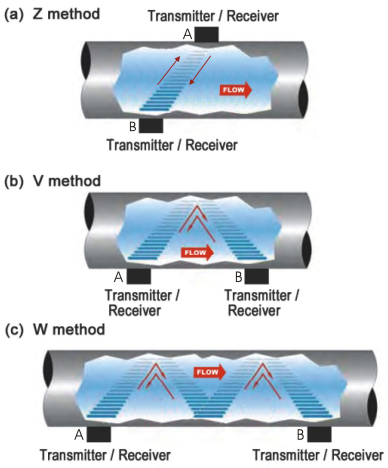


Figure 1

For Industries

6.) Power plant
7.) The flow patrolling and examining
8.) Metallurgy, Laboratory
9.) Energy-conservation, economical water measurement
10.) Food and medicine
11.) Heat measures, Heat balance
12.) On-the-spot check-up, Pipeline leak detection & judgment

1.4 Features

- Advanced Digital Signal Processing (DSP) technology and the MultiBeam™ transducer technology
- Digital Cross-correlation (DCC) technology
- Non-invasive flow system allowing solids to pass through the pipe within effect on meter. No Y-strainers or filtering devices needed
- No-contacting sensor design making no fouling and free maintenance
- Sensors suitable for different pipe materials with wide pipe diameters
- Easy and cost-effective installation by clamping transducers on the outside of existing piping systems
- User-friendly menu selections making DMTF easy operations
- User-configurable in English, Metric and other engineering units worldwide
- Event data logger available in searching the event of totaliser flow

- Parallel operation of positive, negative and net flow totalisers available
- The totalise pulse output and frequency output available via open collector

1.5 Specifications

Transmitter

Description	Specifications
Principle of Measurement	Principle of Transit Time, DSP technology and MultiBeam™ Transducer Technology
Power Requirements	115/230VAC 50/60Hz ± 15% @ 5VA max; 9-28VDC @ 2.5 VA max
Velocity	0 ~ +12 m/s
Outputs Optional	All outputs are isolated form earth and system grounds. 4-20 mA output：1000 ohm max, Accuracy: 0.1% Pulse output：1~9999 Hz (from OCT) for Flow rate or Total flow output
Display	2 line×8character LCD back lit
Units Rate Totaliser	English or Metric units Rate and Velocity Display Forward total; Reverse total; Net total (difference between forward and reverse flow)
Ambient Conditions	-40 to 131F [-40 to 55℃], 0-95% relative humidity, non-condensing
Enclosure	NEMA 4X [IP65] Polycarbonate SS Brass and plated steel 178H×146W×99D mm
Accuracy Flow Rate	±1.0% of reading at rates > 0.3 m/s uncalibrated; ±0.5% of reading at rates > 0.3 m/s for field calibrated systems
Repeatability	±0.2% of reading
Responding Time	500 ms (2 set /seconds),
Communication Interface	(Std) RS-232C, or (Opt) RS-485
Security	Keypad lockout, Password or other access code enable
Other Functions	1.) Automatic record incident and management of flow measurement 2.) Remember the state of the flow meter

	3.) Diagnosis

Transducer

Description	Specifications
Liquid Types	Virtually most any liquid containing less than 5% total suspended solids (TSS) or aeration
Liquid Temperature	Magnetic force transducer, -40 to 180F [-40 to 82℃] (Opt) -40 to 300 F [-40 to 150℃]
Transducer Cable Length	Shielded cable: (Opt) extensive length to 300 meters
Pipe Size	(Std): 1 to 50 inches [25 to 1250 mm] pipe I.D. (Opt): 50 to180 inches [1250- 4570 mm] pipe I.D
Pipe Material	All kinds of steel and cast iron, and PVC

1.6 Model Selection

DMTF-

Transit Time Ultrasonic Flow Meter

Transducer Mounting Method
B.) Clamp-on transducer
C.) Insertion transducer

Transmitter Enclosure
1.) Standard Enclosure
2.) Explosive Proof Enclosure, EEeX II

Input/Output 1
N.) None
1.) 4-20 mA
2.) Rate Pulse
3.) Totaliser Pulse
4.) RS232C
5.) RS485
6.) Heat Flow

Input/Output 2
Same as Input/Output 1

Transducer Type and Temperature
10.) S1 type clamp-on (pipe size 3/4 ~2 inches
-40 to 300F [-40 to 150℃]
11.) S1 type clamp-on (pipe size 3/4 ~2 inches)
Magnetic force transducer, -40 to 180F [-40 to 82℃]
20.) M1 type clamp-on (pipe size 1 ~ 50 inches)
-40 to 300F [-40 to 150℃]
21.) M1 type clamp-on (pipe size 1~50 inches)
Magnetic force transducer, -40 to 180F [-40 to 82℃]
30.) L1 type clamp-on (pipe size 50~180 inches)
Magnetic force transducer, -40 to 180F [-40 to 82℃]

Transducer Cable Length
020.) 20 feet [6.1 m]
050.) 50 feet [15 m]
100.) 100 feet [30 m]
Max. length: 990 feet [300 m] in 10 ft. [3 m] increments

NOTE

1.) One tube of silicone compound is included in a transducer order. While mounting straps are excluded

2.) Stainless steel mounting straps

A.) Part Number (PN) is DM002-2007-001

B.) 36 inches [0.92 m] long and require some overlap

C.) Number of straps required (round up to the next even number) =Pipe outside diameter [inches] x 6.2832 inches

Part 2 - Transducer Installation

2.0 General

Utilised by the DMTF series flow meters, the transducers contain piezoelectric crystals for transmitting and receiving ultrasound signals through walls of liquid piping systems. The transducers are relatively simple and straight-forward to install, but spacing and alignment of the transducers is critical to the system's accuracy and performance. Extra care needs to be taken to ensure that these instructions are carefully executed.

Mounting of the clamp-on ultrasonic transit time transducers is comprised of three steps:

1.) Selection of the optimum location on a piping system

2.) Entering the necessary parameters into the DMTF keypad

NOTE DMTF calculates proper transducer spacing according to these entries in (M25)

3.) Pipe preparation and transducer mounting

2.1 Mounting Location

The first step in the installation process is to select an optimum location for the flow measurement. For this to be done effectively, a basic knowledge of the piping system and its plumbing is required.

An optimum location is defined as:

- **A piping system that is completely full of liquid when measurements are being taken.** The pipe may become completely empty during a process cycle - which will result in an error code being displayed on the flow meter while the pipe is empty. Error codes will clear automatically once the pipe refills with liquid. It is not recommended to mount the transducers in an area where the pipe may become partially filled. Partially filled pipes will cause erroneous and unpredictable operation of the meter

- **A piping system that contains lengths of straight pipe such as those described in Table 2.1**. The optimum straight pipe diameter recommendations apply to pipes in both horizontal and vertical orientation. The straight runs in Table 2.1 apply to liquid velocities that are nominally 7 ft/s [2.2 m/s].

As liquid velocity increases above this nominal rate, the requirement for straight pipe increases proportionally

- **Mount the transducers in an area where they will not be inadvertently bumped or disturbed during normal operation**

- **Avoid installations on downward flowing pipes** unless adequate downstream head pressure is present to overcome cavitations in the pipe.

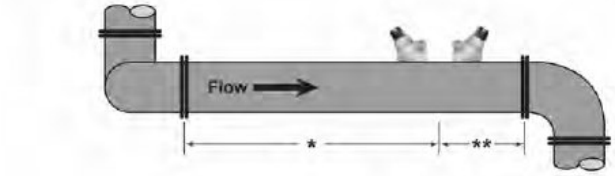
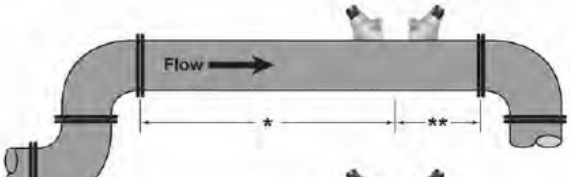
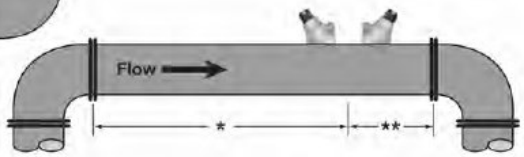
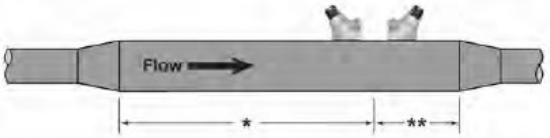
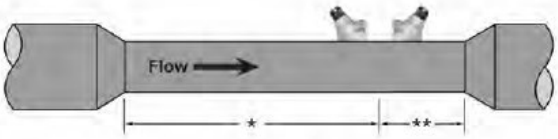
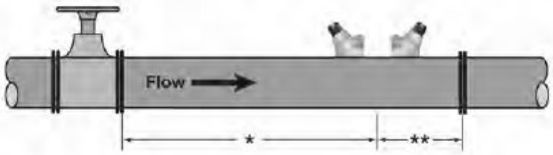
Piping Configuration and Transducer Positioning	Upstream Pipe Diameters	Downstream Pipe Diameters
	*	**
	24	5
	14	5
	10	5
	10	5
	10	5
	24	5

Table 2.1
Straight Pipe Requirements

2.2 Transducer Spacing

DMTF transducers are clamped on the outside of a closed pipe **at a specific distance from each other**.

The transducers can be mounted in:

1.) V-mode where the sound transverses the pipe twice

2.) W-mode where the sound transverses the pipe four times

3.) Z-mode where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once only

For further details, refer to Table 2.2

The appropriate mounting configuration is based on pipe and liquid characteristics. Selection of the proper transducer mounting mode is not entirely predictable and many times is an iterative process. Table 2.2 contains recommended mounting configurations for common applications. These recommended configurations may need to be modified for specific applications if such things as aeration, suspended solids or poor piping conditions are present.
W-mode provides the longest sound path length between the transducers, but has the weakest signal strength, while Z-mode provides the strongest signal strength, but has the shortest sound path length.

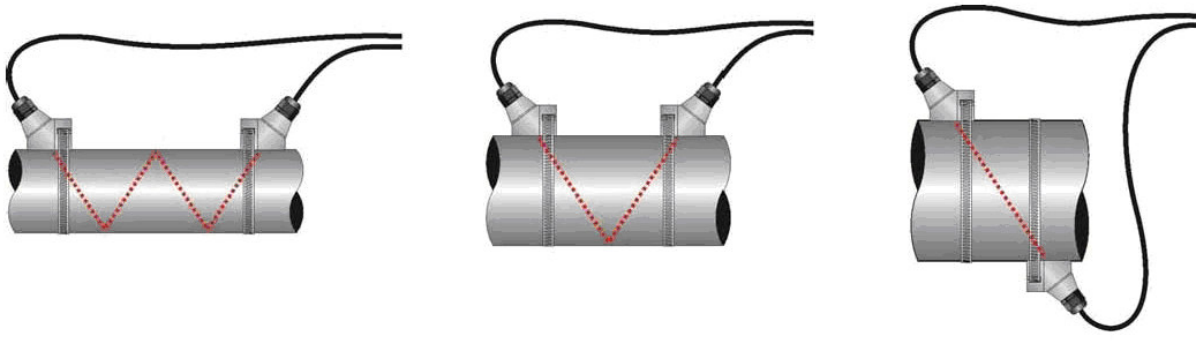
On pipes smaller than 3 inches [75 mm], it is desirable to have a longer sound path length, so that the difference in time interval can be measured more accurately. It is very important to use of the DMTF M90 and M91 in determining the optimum transducer mounting.

Table 2.2
Transducer Mounting Modes

Transducer Mount Mode	Pipe Material	Pipe Size	Liquid Composition
W-Mode	Plastic (all types)	1-6 in. (25-150 mm)	Low TSS; non-aerated
	Carbon Steel	1-4 in. (25-100 mm)	Low TSS; non-aerated
	Stainless Steel	1-6 in. (25-150 mm)	Low TSS; non-aerated
	Copper	1-6 in. (25-150 mm)	Low TSS; non-aerated
	Ductile Iron	Not recommended	
	Cast Iron	Not recommended	
V-Mode	Plastic (all types)	6-30 in. (150-750 mm)	Low TSS; non-aerated
	Carbon Steel	4-24 in. (100-600 mm)	Low TSS; non-aerated
	Stainless Steel	6-30 in. (150-750 mm)	Low TSS; non-aerated
	Copper	6-30 in. (150-750 mm)	Low TSS; non-aerated
	Ductile Iron	3-12 in. (75-300 mm)	Low TSS; non-aerated
	Cast Iron	3-12 in. (75-300 mm)	Low TSS; non-aerated
Z-Mode	Plastic (all types)	> 30 in. (> 750 mm)	Low TSS; non-aerated
	Carbon Steel	> 24 in. (> 600 mm)	Low TSS; non-aerated
	Stainless Steel	> 30 in. (> 750 mm)	Low TSS; non-aerated
	Copper	> 30 in. (> 750 mm)	Low TSS; non-aerated
	Ductile Iron	> 12 in. (> 300 mm)	Low TSS; non-aerated
	Cast Iron	> 12 in. (> 300 mm)	Low TSS; non-aerated

TSS = Total Suspended Solids

Transducer Mounting Modes



W method Configuration

V method Configuration

Z method Configuration

The DMTF system calculates proper transducer spacing by utilising piping and liquid information entered by the user.
The following information is required before programming the instrument.

NOTE

Parameters relating to material sound speed, viscosity and specific gravity are preprogrammed into the DMTF flow meter. These parameter values only need to be modified if there is an unknown pipe material or a particular liquid varying from the reference.
Refer to Part 3 of this manual for instructions on entering configuration data into the DMTF flow meter via the meter keypad
See Table 2.2 Transducer mounting mode.

Pipe outside diameter (O.D.)
Pipe wall thickness
Pipe material
Pipe sound speed
Pipe relative roughness
Pipe liner thickness
Pipe liner material
Pipe liner sound speed
Fluid type
Fluid sound speed

Nominal values for these parameters are programmed within the DMTF operating system. The nominal values may be used when appear or may be modified if exact system values are known.
After entering the data listed above, the DMTF will calculate proper transducer spacing for the particular data settings. This distance will be in inches if the DMTF is configured in English units, or millimeters if it is configured in Metric units.

2.3 Transducer Mounting

After selecting an optimum mounting location (Step 1) and properly entered above parameters via the meter keypad (Step 2), it's time to turn to determine the proper transducer spacing (Step 3). The transducers may now be mounted onto the pipe.
The transducers must be properly oriented on the pipe to provide optimum reliability and performance. On horizontal pipes, the transducers should be mounted 180 radial degrees from one another and at least 45 degrees from the top-dead-center and

bottom-dead-center of the pipe. See Figure 2.1 Transducer Orientation – Horizontal Pipes. **NOTE** Figure 2.1 does not apply to vertically oriented pipes.

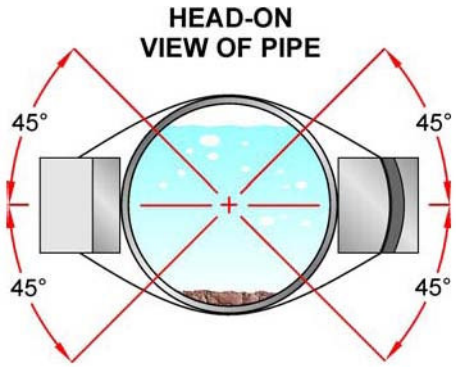


Figure 2.1
Transducer Orientation—Horizontal Pipes

Pipe Preparation

Before the transducers are mounted onto the pipe surface, two areas slightly larger than the flat surface of the transducer heads must be cleaned of all rust, scale and moisture. For pipes with rough surfaces, such as ductile iron pipe, it is recommended that the pipe surface be ground flat. Paint and other coatings, if not flaked or bubbled, need not be removed. Plastic pipes typically do not require surface preparation other than soap and water cleaning.

Observe Signal Strength while placing the transducers into position. Signal Strength displays in Menu 90.

V-Mode and W-Mode Installation

1.) For DMTF transducers, place a single bead of couplant, approximately 0.05 inch [1.2 mm] thick, on the flat face of the transducer. See Figure 2.2. Generally, a silicone-based grease is used as an acoustic couplant, but any grease-like substance that is rated not to “flow” at the temperature that the pipe may operate at, will be acceptable.

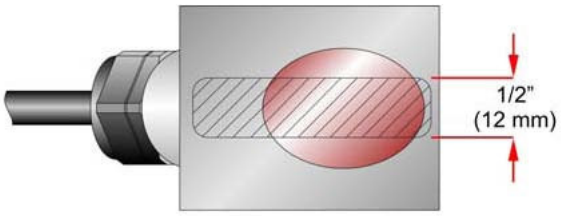


Figure 2.2

2.) Place the upstream transducer in position and secure with a mounting strap. Straps should be placed in the arched groove on the end of the transducer. A screw is provided to help hold the transducer onto the strap. Verify that the transducer is true to the pipe - adjust as necessary. Tighten the transducer strap securely

3.) Place the downstream transducer on the pipe at the calculated transducer spacing. See Figure 2.3 Transducer Position. Using firm hand pressure, slowly move the transducer both towards and away from the upstream transducer while observing Signal Strength. Clamp the transducer at the position where the highest Signal Strength is observed. A Signal Strength (in M90) between 60 and 95 is acceptable

4.) If after adjustment of the transducers, the Signal Strength (in M90) does not rise to above 60, then an alternate transducer mounting mode should be selected. If the mounting mode is W-mode, then reconfigure the DMTF for V-mode, reset the DMTF, move the downstream transducer to the new location and repeat Step 3.

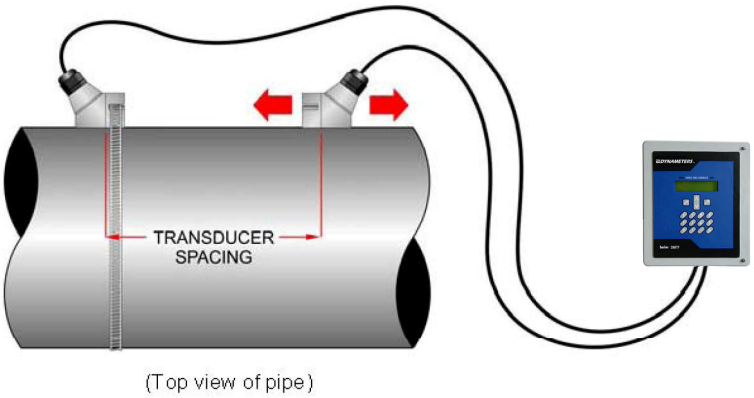


Figure 2.3
Transducer Position

Z-Mode Installation

Installation on larger pipes requires careful measurements to the linear and radial placement of the L1 transducers. *Failure to properly orient and place the transducers on the pipe may lead to weak signal strength and/or inaccurate readings.* The section below introduces a method for properly locating the transducers on larger pipes. This method requires a roll of paper such as freezer paper or wrapping paper, masking tape and a marking device:

1.) Wrap the paper around the pipe in the manner shown in Figure 2.4. Align the paper ends to within 0.25 inches [6 mm]

2.) Mark the intersection of the two ends of the paper to indicate the circumference. Remove the template and spread it out on a flat surface. Fold the template in half, bisecting the circumference. See Figure 2.5

3.) Crease the paper at the fold line. Mark the crease. Place a mark on the pipe where one of the transducers will be located. See Figure 2.1 for acceptable radial orientations. Wrap the template back around the pipe, placing the beginning of the paper and one corner in the location of the mark. Move to the other side of the pipe and mark the pipe at the ends of the crease. Measure from

the end of the crease

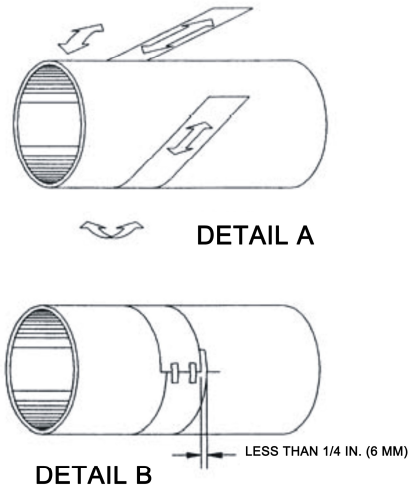


Figure 2.4
Paper Template Alignment

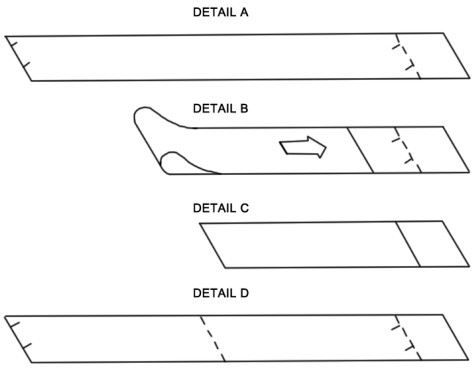


Figure 2.5
Bisecting the pipe cirumference

(directly across the
pipe from the first transducer location) the dimension derived in Step 2, Transducer Spacing. Mark this location on the pipe

4.) The two marks on the pipe are now properly aligned and measured.
If access to the bottom of the pipe prohibits the wrapping of the paper around the circumference, cut a piece of paper to these dimensions and lay it over the top of the pipe.
Length = Pipe O.D. X 1.57
Width = Spacing
Mark opposite corners of the paper on the pipe. Apply transducers to these two marks

5.) Place a single bead of couplant, approximately 0.05 inch [1.2 mm] thick, on the flat face of the transducer. See Figure 2.2. Generally, a silicone-based grease is used as an acoustic couplant, but any grease-like substance that is rated to not “flow” at the temperature that the pipe may operate at, will be acceptable.

Place the upstream transducer in position and secure with a stainless steel strap or other. Straps should be placed in the arched groove on the end of the transducer.
A screw is provided to help hold the transducer onto the strap. Verify that the transducer is true to the pipe - adjust as necessary. Tighten transducer strap securely. Larger pipes may require more than one strap to reach the circumference of the pipe

6.) Place the downstream transducer on the pipe at the calculated transducer spacing. See Figure 2.6. Using firm hand pressure, slowly move the transducer both towards and away from the upstream transducer while observing Signal Strength. Clamp the transducer at the position where the highest Signal Strength is observed. Signal Strength of between 5 and 95 percent is acceptable. On certain pipes, a slight twist to the transducer may cause signal strength to rise to acceptable levels

7.) Secure the transducer with a stainless steel strap or other strap

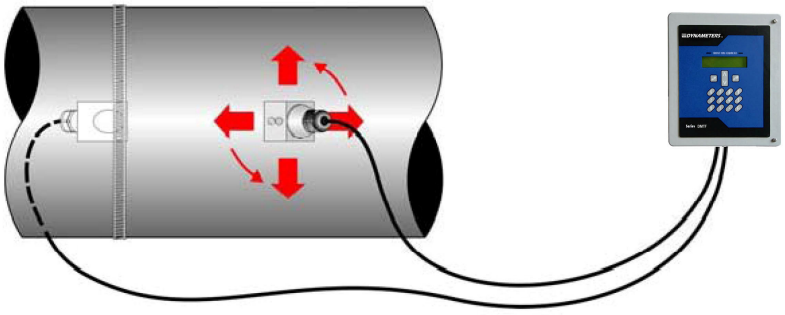


Figure 2.6
Z-Mode Transducer Placement

2.4 Transducer Mounting Inspection and Couplant Application

2.4.1 Transducer Mounting Inspection

It is very important to use menu operations for TRANSDUCER MOUNTING INSPECTION and Estimation

Refer to §5.16, using menu windows for Transducer Mounting Inspection

2.4.2 Couplant Application

1.) It is also very important for couplant application. When mounting the transducers, apply just enough pressure so that the couplant can eliminate the gap between the pipe and transducer. Commonly, Dow Corning 732 is used for permanent installation while Dow Corning 111 is used for temporary installation

NOTE

When Dow Corning 732 is used, ensure:

A.) No relative movement between the transducers

B.) The pipe takes place during the setting time，and

C.) Do not apply instrument power for at least 24 hours

Dow Corning 111 is also used for permanent installations (avoid rain or water), setting time is not necessary. Dow Corning 112 is suitable for high temperature application

2.) Transducers for High Temperature

Mounting of high temperature transducers is similar to DMTF standard transducers. High temperature installations require acoustic couplant Dow Corning 112 that is rated not to flow at the temperature that will be present on the pipe surface

Part 3 - Instructions on Installation,

Connection and Operation

3.1 Transmitter Installation

After unpacking, it is recommended to save the shipping carton and packing materials in case the instrument is stored or re-shipped. Inspect the equipment and carton for damage. If there is evidence of shipping damage, notify the carrier immediately.

The enclosure should be mounted in an area that is convenient for servicing, calibration or for observation of the LCD readout (if equipped):

1.) Locate the transmitter within the length of transducer cable that is supplied with the DMTF system. If not possible, it is recommended that the cable be replaced with the one having proper length. Transducer cable that is up to 990 feet [300 meters] may be accommodated

2.) Mount the DMTF transmitter in a location where is:

- Little vibration existing
- Protected from falling corrosive fluids
- Within ambient temperature limits: -40 to 185°F [-40 to 85°C]
- Avoiding direct sunlight: Direct sunlight may increase transmitter temperature to above the maximum limit

3.) Mounting: *Refer to Figure 3.1 for enclosure and mounting dimension details*. Ensure that enough room is available to allow for door swing, maintenance and conduit entrances. Secure the enclosure to a flat surface with four appropriate fasteners

4.) Conduit holes: Conduit hubs need to be used where cables enter the enclosure. Holes not used for cable entry should be sealed with plugs

5.) If additional holes are required, drill the appropriate size hole in the enclosure's bottom. Take extra care not to drill a bit into the wiring terminals or electronic circuit boards

NOTE

Use NEMA 4 [IP65] rated fittings/plugs to maintain the water tight integrity of the enclosure. Generally, the left conduit hole (viewed from front) is used for the power supply, the center conduit hole is used for transducer Inputs, and the right hole is used for Output wirings

MECHANICAL DIMENSIONS: INCHES [MM]

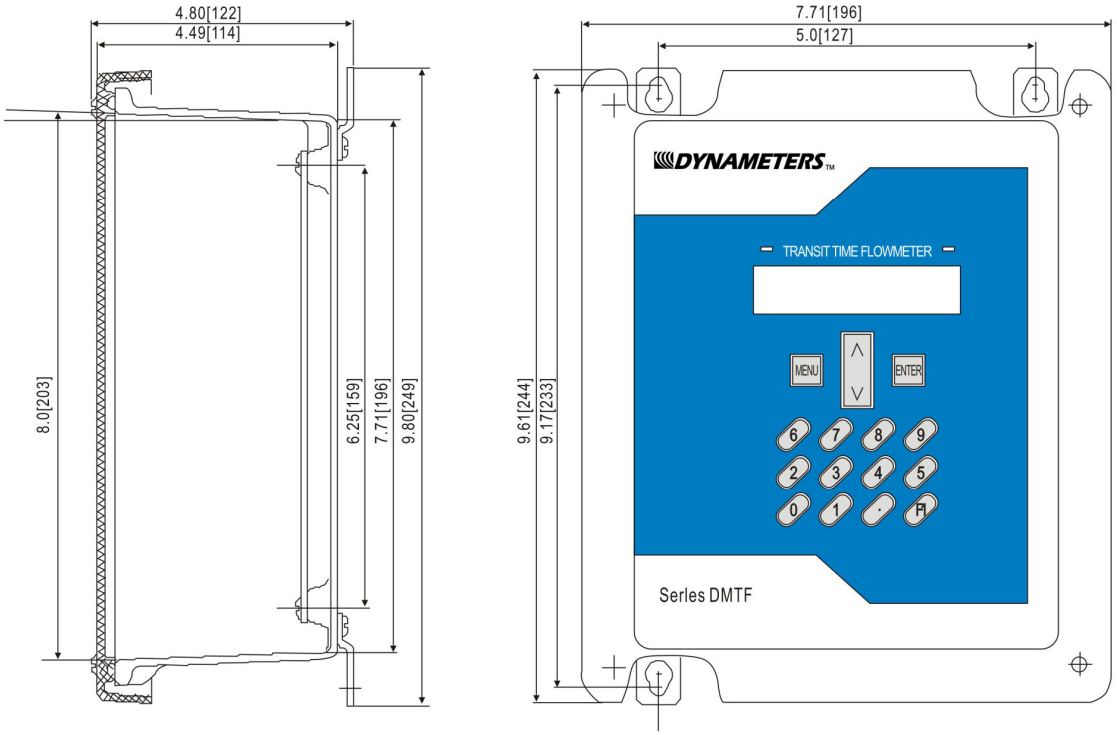


Figure 3.1

3.2 Transducer Input Connections

To access terminal strips for transducer connections:

1.) Loosen two screws on the enclosure door first and then open the door

2.) Guide the transducer terminations through the transmitter conduit hole located in the bottom-center of the enclosure

3.) The terminals in the transmitter are a pluggable type: which can be removed wirings and then plugged back in. Connect the

appropriate wires to the corresponding screw terminals in the transmitter

4.) Observe UP/DN Str. Xdcr orientation: If flow rate displays negative, exchange the UP/ DOWN transducer wirings

NOTE

A.) The transducer cable carries low level high frequency signals. In general, it is not recommended to arrange other cable with the transducer cable

B.) If additional cable is required, contact the Dynameters factory to make an exchange for the transducer cable with appropriate length

C.) Transducer cable is available to extend to 990 feet [300 meters]

3.3 Transmitter Power Supply and Output Connections

1.) Power Supply Connection

AC Power Connection: Connect line power input wires *(115 / 230 VAC, 50 / 60 Hz ± 15% @ 5 VA max)* to the 220VAC Screw Terminals: **AC**, **GND** in the transmitter. See Figure 3.2. The ground terminal grounds the instrument, which is mandatory for safe operation.

DC Power Connection: Connect DC power input wires *(9 to 28 VDC @ 2.5 VA max)* to the 24VDC Screw Terminals: **+** and **–** in the transmitter.

NOTE

This instrument requires clean electrical line power. Do not operate this unit on circuits with noisy components (for example, fluorescent lights, relays, compressors, or variable frequency drives). It is recommended not to run line power with other signal wires within the same wiring tray or conduit.

Figure 3.2

2.) 4-20 mA Output Connection

Connect 4-20mA output wires to the 4–20 mA Screw Terminals: **+**, **-** in the transmitter. Please note that the 4-20 mA output does not require power from an external DC power source

3.) Pulse Frequency Output Connection

Connect Pulse Frequency Output wires to the "Pulse F. Out" Terminals: **+**, **-** in the transmitter. The pulse output is utilised of transmit information to external counters and PID systems via a frequency output that is proportional to flow rate or total flow (can be configured in the Menu) of the system. The frequency output ranges from 0 –1,000 Hz

NOTE

A.) This type of pulse output is an open-collector transistor (OCT) type that does not have a internal power source as its output, requiring an external DC power source and pull-up resistor

B.) Resistor selection is based on the input impedance of the receiving device. Select a resistor that is a maximum of 10% of the input impedance of the receiving device, but do not exceed 10k Ohms

C.) See Figure 3.3: The voltage value of External DC power Supply depends on Pulse Output receiver. Normally, 1 - 24V is allowable

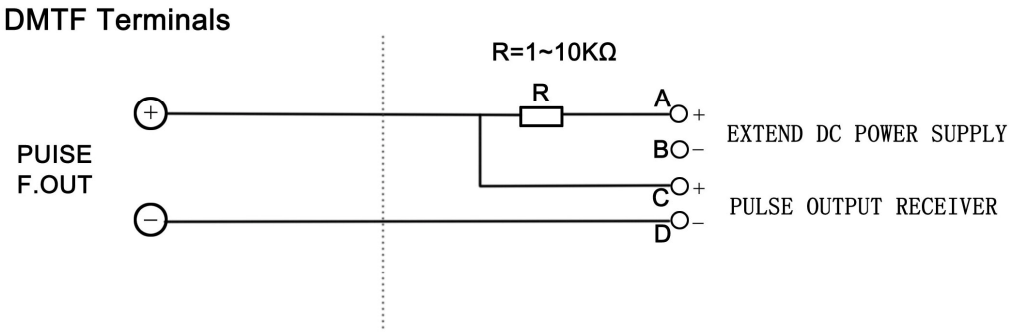


Figure 3.3

3.4 Keypad Configuration

3.4.1 Keypad functions

After installation of transducers and connection of appropriate power supply to DMTF, keypad configuration of the instrument can be undertaken. Generally, there is no any display of error messages. The flow meter can go to the most commonly used Menu Window Number 01 (M01), which displays the Velocity, Flow Rate, Positive Totaliser, Signal Strength and Signal Quality according to the pipe parameters entering by the user or by the initial program.

The DMTF contains a 16-key tactile keypad, allowing the user to view and change parameter configurations, which is as shown below (Figure 3.4).

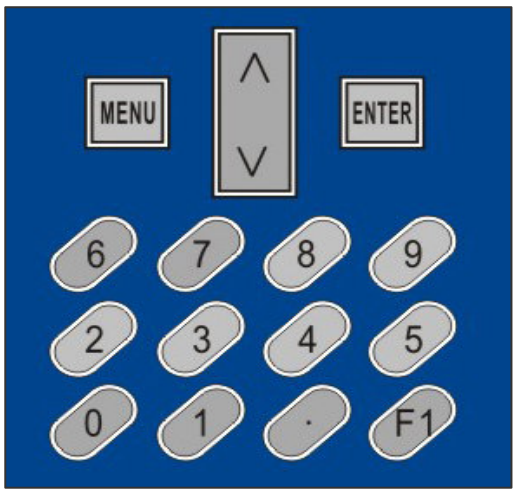


Figure 3.4

Follow these guidelines when using DMTF keypad:
Keys **0** ~ **9** and • used to input numbers and decimal

Key F1 used to backspace or delete characters to the left

The arrow keys ∧ and ∨ used to return to the last menu or to open the next menu, scrolling through menu for parameter configurations; also to act as "+" and "-" functions when entering numbers

Key **MENU** is used to select a menu. To enter a desired window, press **MENU** key first, and then followed by input two-digit window address code. For instance, to input a pipe wall thickness, press **MENU** key first and then press **1** and **2** keys. Window M12 is the menu to display the pipe wall thickness, and 12 is the Window address code or the serial number

3.4.2 Keypad Operation

With all of the parameters entered, the instrument setup and measurement displays are subdivided or consolidated into more than 100 independent windows. The user can view the window menu, input parameters, modify settings or display measurement results. These windows are arranged by 2-digit serial numbers (including ∧ symbol) from 00 to 99, then to ∧ **0**, ∧ **1**, and so on. Every window serial number, or so-called window address code, has a defined meaning. For instance, Window No.11 (M11) indicates the input for the pipe outside diameter, while Window M25 indicates the mounting space between the transducers. For details about window menus, please *refer to Part 4 – Windows Display Explanations*

A.) The keypad shortcut to visit a specific window is to press the **MENU** key at any time, and then followed by input 2-digit window address code. For instance, to input or check the pipe outside diameter, just press the **MENU**, **1** and **1** keys for entering window M11

B.) Another method to visit a specific window is to press ∧, ∨ and **ENTER** keys to scroll the menu. For instance, if the current window is M66, press ∧ key to enter Window M65, press the ∧ again to enter Window M64; then, press the ∨ key to back Window M65, and press the ∨ key again to enter Window M66

Example 1

To enter a pipe outside diameter of 216.2, the procedure is as follows:

Press **MENU**, 1 and 1 keys to enter Window M11 (The displayed value currently is a previous value,). *Please refer to the left Figure below*. Now press **ENTER** key. The symbol " > " and the flashing cursor are displayed at the left end of the second line on the Screen. *Please refer to the right Figure below.* The new value can be entered by pressing **2**, **1** , **6** , **•** , **2** keys and finally pressing **ENTER** key to confirm.

Input pipe outside diameter M11 312 mm (previous value)	Input pipe outside diameter M11 > (once enter is pressed, input new value here

Example 2

If the pipe material is "Stainless Steel", press keys **MENU** **1** **4** to enter Window M14 first. Then press **ENTER** key to modify the options. Now, select the "1. Stainless Steel" option by pressing ∧ and ∨ keys, and finally press **ENTER** key to confirm the selection. It is possible to press **1** key to change the selection and wait until "1. Stainless Steel" is displayed on the second line of the screen. Then press the **ENTER** key to confirm.

Generally, press **ENTER** key first if operator wants to enter "modify" condition. If the "modify" is still not possible even after pressing the **ENTER** key, it means that system is locked by a password. To unlock it, select "Unlock" in Window M47 and enter the original password. The keypad will not respond if the keypad is locked. It can only be unlocked by the entering original password. Select keypad lock functions in Window M48. Please contact the factory for password issues if necessary.

3.4.3 DMTF Window Descriptions

The DMTF has a unique feature of windows processing for all operations.

These windows are assigned as follows:

M00～M09 windows for displaying flow rate, velocity, positive total, negative total, net total, date & time, present operation and flow results today

M10～M29 windows for initial parameter settings: To setup pipe outside diameter, pipe wall thickness, fluid type, transducer type, transducer mounting and spacing

M30～M38 windows for flow units setup options: To select the flow unit, totaliser unit, measurement unit, turn totalisers on/off and reset totalisers

M40～M49 windows for setup options: To setup scale factor, network IDN (Window M46), system lock (Window M47) and keypad lock code (Window M48)

M50～M89 windows for Input and output setup: To configure relay output setup, 4-20mA outputs, flow batch controller, LCD backlit option, date and time, low/high output frequency, alarm output, date totaliser

M90～M94 windows for diagnosis: Signal strength and signal quality (Window M90), TOM/TOS*100 (Window M91), flow sound velocity (Window M92), total time and delta time (Window M93), Reynolds number and factor (Window M94)

M∧0～M∧8 appendix: Power on/off time, total working hours, on/off times and hardware adjustment, which is used by the manufacturer only

For further information, refer to Part 4 – Windows Display Explanations. When having questions, please follow the step-by-step instructions in the following section *(Refer to § 3.4.4 Pipe Parameter Entry Shortcuts).*

3.4.4 Pipe Parameter Entry Shortcuts

The following parameters need to be entered for a normal measurement:

1.) Pipe outside diameter
2.) Pipe wall thickness
3.) Pipe material
4.) Liner material parameters (including thickness and sound speed, if needed)
5.) Fluid type
6.) Transducer type (The transmitter is connected with various

transducer types: For DMTFB, the transducer can be a S1, M1, or L1 type. While for DMTFC, the transducer is the Plug-in type - B45 only.)

7.) Transducer mounting methods, (*Refer to Part 2, W-, V-, and Z- mountings)*

According to the above-stated order, to setup these parameters by the following keypad shortcuts:

1.) Press **MENU** **1** and **1** keys to enter Windows M11 first, and then enter the pipe outside diameter value, and finally press the **ENTER** key to confirm

2.) Press the ∨ key to enter Window M12 first, and then enter pipe wall thickness value, and finally press **ENTER** key to confirm

3.) Press the ∨ key to enter Window M14 first, press the **ENTER** key to modify, move the ∧ or ∨ key to select a right pipe material, and press the **ENTER** key to confirm

4.) Press the ∨ key to enter Window M16 first, press the **ENTER** key to modify, move the ∧ or ∨ key to select a right liner material, and press the **ENTER** key to confirm

5.) Press the ∨ key to enter Window M20 first, press the **ENTER** key to modify, move the ∧ or ∨ key to select the fluid type, press the **ENTER** key to confirm

6.) Press the ∨ key to enter Window M23 first, press the **ENTER** key to modify, move the ∧ or ∨ key to select a right transducer type, and press the **ENTER** key to confirm

7.) Press the ∨ key to enter Window M24 first, press the **ENTER** key to modify, move the ∧ or ∨ key to select a right transducer-mounting method, and press the **ENTER** key to confirm

8.) Press the ∨ key to enter Window M25, accurately install the transducers according to the displayed transducer mounting spacing and the selected mounting method *Refer to Part 2 – Installation of the Transducers*

9.) Press the **MENU** **0** **1** keys to enter Window M01 to display measurement result

Part 4 - Windows Display Explanations

Windows Display Explanations

Menu window No.	Functions
M00	Display flow rate / net totaliser
M01	Display flow rate / velocity
M02	Display flow rate / positive flow
M03	Display flow rate / negative flow
M04	Display date/flow rate
M05	Display heat flow rate
M06	Display analog signals input
M07	Display analog signals input
M08	Display system error codes
M09	Display Net flow today
M10	Window for entering the pipe outer perimeter (commonly not used if input outer diameter below)
M11	Window for entering the pipe outer diameter, 0 to 6000 mm is the allowable range.
M12	Window for entering the pipe wall thickness
M13	Window for entering the pipe inner diameter of the pipe
M14	Window for selecting the pipe material Standard pipe materials (that have been programmed into the flow meter and users ignore to know the sound velocity in the material), including: 0.) Carbon steel 1.) Stainless steel 2.) Cast iron 3.) Ductile iron 4.) Copper 5.) PVC 6.) Aluminum 7.) Asbestos 8.) Fiberglass 9.) Other
M15	Window for entering the pipe material sound velocity only for non-standard pipe materials if selecting “Other” in M14
M16	Window for selecting the liner material, select <u>none</u> for pipes without any liner. Standard liner materials (that the user does not need to know the sonic velocity in the material), including: 0.) None, No liner 1.) Tar Epoxy 2.) Rubber 3.) Mortar 4.) Polypropylene 5.) Polystryol 6.) Polystyrene 7.) Polyester 8.) Polyethylene 9.) Ebonite 10.) Teflon 11.) Other
M17	Window for entering the liner material sound velocity

	only for non-standard liner materials if selecting "Other" in M16
M18	Window for entering the liner thickness, if there is a liner
M19	Window for entering the roughness of the inside wall of the pipe
M20	Window for selecting fluid type For standard liquids (that the user does not need to know the liquid sonic velocity), including: 0.) Water 1.) Sea Water 2.) Kerosene 3.) Petrol 4.) Fuel oil 5.) Crude Oil 6.) Propane at -45℃ 7.) Butane at 0℃ 8.) Other 9.) Diesel Oil 10.) Caster Oil 11.) Peanut Oil 12.) Petrol #90 13.) Petrol #93 14.) Alcohol 15.) Hot water at 125 ℃
M21	Window for entering the fluid sound velocity only for non-standard liquids if selecting "Other" in M20
M22	Window for entering the viscosity of the non-standard liquids if selecting "Other" in M20
M23	Window for selecting the proper transducer type There are different types of transducers for selection: DMTF-B: selecting S1, M1, or L1 type DMTF-C: selecting Plug-in type B45 only
M24	Window for selecting the transducer mounting methods. Four methods can be selected: 0.) V-method 1.) Z-method 2.) N-method 3.) W-method
M25	Window for displaying the transducer mounting spacing
M26	Entry to save the parameter setups into the internal
M27	Display liquid cross section area
M28	Select **YES** or **NO** for the instrument to determine whether or not to hold (or to keep) the last correct value when poor signal condition occurs. YES is the default setup
M29	Setting state of empty pipe
M30	Window for selecting unit system. Default value is "Metric". The change from English to Metric or vice versa will not affect the unit for totalisers
M31	Window for selecting flow rate that will be used by the instrument afterward

	Flow rate can be in unit of 0.) Cubic meter (m3) 1.) Liter (l) 2.) U.S. gallon (gal) 3.) Imperial Gallon (igl) 4.) Million USA gallon (mgl) 5.) Cubic feet (cf) 6.) USA liquid barrel (bal) 7.) Imperial liquid barrel (ib) 8.) Oil barrel (ob) The flow unit in terms of time can be per day, per hour, per minute or per second. So there are 36 different flow rate units totally for selection
M32	Window for selecting the totalisers' working unit default is m^3
M33	Select totaliser multiplier The multiplier ranges from 0.001 to 10000 Default value is ×1
M34	Turn on or turn off the NET totaliser
M35	Turn on or turn off the POS totaliser
M36	Turn on or turn off the NEG totaliser
M37	1.) Totaliser reset selection 2.) Restore the instrument to the default parameters by pressing ● and **F1** keys Take care to make a record on the original settings for parameters before doing the restoration
M38	Manual Totaliser On/Off setup
M39	Operational interface language selection between Chinese and English
M40	Flow rate damping setup for a stable value. The input range is 0 to 999 seconds "0" means there is no damping. Default value is 10 seconds
M41	Lower flow rate cut-off to avoid invalid accumulation
M42	Zero point setup under the condition when there is no liquid running inside the pipe
M43	Clear the zero point set by the user, and restore the zero point set by the manufacturer
M44	Set up a manual flow bias. Generally this value is 0
M45	Scale factor setup for the instrument. The default

	value is 1. Keep this value as “1”, when no calibration has been made
M46	Network environment Identification Number. Not used
M47	System locker to avoid modification of parameters
M48	Keypad locker (Password setup via keypad)
M49	Communication tester
M50	Data logger option
M51	Logger time setup for the data logger
M52	1.) Data logging direction control. printing “To RS-232” is selected, all data produced by the data logger will be transmitted out through the RS-232C interface
M53	Analog Input - AI5
M54	AI5 value range setup
M55	Mode of current output
M56	The flow rate value at 4 mA output opposite
M57	The flow rate value at 20 mA output opposite
M58	Current loop (CL) checkup, press **ENT** when ready
M59	CL output
M60	Enactment the date and time of the system
M61	Window for displaying Version information and Electronic Serial Number (ESN) that is a unique for each DMTF series flow meter
M62	RS-232C serial port setup
M63	Analog input - AI1 value range setup
M64	Analog input - AI2 value range setup
M65	Analog input - AI3 value range setup
M66	Analog input - AI4 value range setup
M67	Setup the frequency output range (FO). The biggest range is 0 - 9999 Hz. Default value is 1-1001 Hz
M68	Setup a low FO flow rate value
M69	Setup a high FO flow rate value
M70	LCD display backlit control option The entered value indicates how many seconds the backlit will be on with every key pressing
M71	LCD contrast control. The LCD will become darker when a small value is entered
M72	Working timer. It can be cleared by pressing **ENTER** key, and then select **YES**
M73	Setup the low flow rate value that will trigger the Alarm #1

	There are two virtual alarms in the system. By “virtual” means that the user must redirect the output of alarms by setup the output hardware in M78 and M77
M74	Setup the high flow rate value that will trigger the Alarm #1
M75	Setup the low flow rate value that will trigger the Alarm #2
M76	setup the high flow rate value that will trigger the Alarm #2
M77	Buzzer setup If a proper input source is selected, the buzzer will beep when the trigger event occurs 0.) No signal 1.) Poor Signal 2.) Not ready (No*R) 3.) Reverse flow 4.) Analog output (AO) overflow100% 5.) Frequency output (FO) overflow120% 6.) Alarm #1 7.) Alarm #2 8.) Batch control 9.) POS totaliser input pulse 10.) NEG totaliser input pulse 11.) Net totaliser input pulse 12.) Energy totaliser input pulse 13.) Communication ON/OFF via RS-232C 14.) Fluid changed 15.) Key stroking ON 16.) Not used
M78	OCT output setup (Pulse output for flow rate or total flow)
M79	Relay output setup
M80	Flow batch control in
M81	Flow batch controller
M82	Date totaliser selection: 0.) Day 1.) Month 2.) Year
M83	Auto gain the totaliser flow if system power off
M84	Not used

M85	Not used
M86	Not used
M87	Not used
M88	Not used
M89	Not used
M90	Window of displaying signal strength, signal quality, time ratio on the upper right corner *IMPORTANT!
M91	Window of displaying the Time Ratio between the Measured Total Transit Time and the Calculated time. If the pipe parameters are entered correctly and the transducers are properly installed, the ratio value should be in the range of 100±3%. Otherwise the entered parameters and the transducer installation should be checked *IMPORTANT!
M92	Window of displaying the estimated fluid sound speed If this value has an obvious difference with the actual fluid sound speed, pipe parameters entered and the transducer installation should be checked again
M93	Window of displaying total transit time and delta time(transit time difference)
M94	Window of displaying the Reynolds number and the pipe factor used by the flow rate program
M95	Open the circle display function
M∧0	Browse the 64 recorded instrument power-on and power-off date and time with the flow rate at the time of power on and off
M∧1	Window of displaying the total working time of the instrument
M∧2	Window of displaying the last power-off date and time
M∧3	Window of displaying the last power-off flow rate
M∧4	Window of displaying the times of instrument powered on(the instrument has been powered on)
M∧5	A scientific calculator for the convenience of field working. All the values are in single accuracy The drawback is that the user can't operate it by direct key-pressing
M∧6	Enter the liquid sound speed change
M∧7	Protocol selection
M∧8	Ultrasonic Wave Shape
M∧9	Energy rate setup

NOTE

Some contents in the windows are not listed or displayed in new software version. However this situation does not affect users to operate DMTF series. By pressing ∧ or ∨ to scroll the menu windows, users can easily view or change some parameter if necessary.

Part 5 - How to Use Menu Functions

5.1 How to Judge Whether the Instrument Works Properly

In general,

- when "**R**" is displayed in the lowest right corner of LCD screen, the instrument is working properly.
- If a "**H**" is flashing on that place, it could be a poor signal received.
- If an "**I**" is displayed, it means no signal detected.
- If a "**J**" is displayed, it means that the hardware could be out of order.

Refer to Part 6 for diagnosis.

5.2 How to Judge the Liquid Flowing Direction

Make sure that the instrument works properly

Check the flow rate:

1.) If the displayed value is "**+**" will it is "positive"; if the displayed value is "**-**", it is "negative"

2.) If the displayed value is "positive", the direction of the flow will be from the Upstream transducer to the Downstream transducer; if the displayed value is "negative", the direction of the flow will be from the Downstream transducer to the Upstream transducer

5.3 How to Reset the Instrument into Default Settings

Enter M37 when displaying the "selection" message. Press the dot key **.** first and the message "Master Erase" will display, then press the backspace key **F1**. The master erase step will erase all the parameters entered by the user and setup the instrument in default status.

5.4 How to Stabilise the Flow

The damping acts as a filter for a stable reading. If "0" is entered in window M40, it means there is no damping. A bigger number brings more stable effect. But bigger damping numbers prevent the instrument from acting quickly. Numbers: 0 to 10 are commonly used for the damping setup.

5.5 How to Use the Zero-Cutoff Function

The displayed value in window M41 is called the low-cutoff value.

The flow rate is “Zero” when the flow rate value that is absolutely less than the low-cutoff value, which is configured by the user. It is useful that the flow meter will avoid any invalid accumulation when the actual flow is below the zero or low-cutoff value. The low-cutoff value does not affect the flow measurement when the actual flow is absolutely above the low-cutoff value.

5.6 How to Setup a Zero Flow Calibration

It is necessary to establish the true zero flow condition and program such a zero set point into the instrument. If the zero set point is not at true zero flow, a measurement difference may occur. Because every flow meter installation is slightly different and sound waves can travel in slightly different ways through these various installations, a provision is made in this entry to establish “True Zero” flow – SET ZERO.

There exists a “Zero Point” in a certain installation condition, which means the flow meter will display a non-zero value when the flow is absolutely stopped. In such a case, setting a zero point in Window M42 will generate a more accurate measurement result.

To Successfully Zero the Flow Meter

1.) The pipe is full of liquid

2.) Flow is absolutely stopped - securely close any valves and allow time for any settling to occur

3.) Enter Window M42 by pressing the **MENU** **4** **2** keys

4.) Press **ENTER** key and wait until the counter readings displayed in the lower right corner of the screen goes to “00”

5.) Thus, the zero set procedure is complete

6.) Repeat zero set calibration if the flow still needs to be minimised, for example, the velocity reading is still high

7.) Check results through Window M01

5.7 How to Use Scale Factor

Scale factor refers to the ratio of “Actual value” and “Reading value”. For example, when the measurement is 2.00, while it indicates 1.98 on the instrument, the scale factor value is 2/1.98. The best scale factor constant is 1. However, it is difficult to keep the constant as “1” on the instrument, especially in batch control operations. The difference is called “consistency”. High quality products always require high consistency.

The default value of scale factor is "1" for each instrument, which is setup prior to shipment from the factory. The reason is that the scale factors in DMTF flow meter is only limited by two parameters: the crystal oscillation frequency and the transducer. It has no relation to any circuit parameters. During an operation, there still exists possible difference in pipe parameters. The "scale factor" may be necessary when used on different pipes. Thus, scale factor calibration is specially designed for calibrating the differences that result from application on different pipes. The scale factor entered must be one that results from actual calibration.

5.8 How to Use the Operation Locker

The system locker provides a means of preventing inadvertent configuration changes or totaliser resets. Using the M48 when the system is locked, menu window browsing can be done without affecting any change, but any modifications are prohibited.

The system can be locked without a password or with a one 1 to 8 digit password. With a no-password locking, directly press the **ENTER** key when the password input prompt displays.
If the password is an issue, please contact the factory.

5.9 How to Use the 4-20 mA Output

Possessing a current loop output exceeding an accuracy of 0.1%, the DMTF is programmable and configurable with multiple current output modes, such as 4-20 mA or 0-20 mA in Window M55. Enter the 4 mA flow value in Window M56, and enter the 20 mA flow value in Window M57.

For details about analog output setup,refer to Part 4 – Windows Display Explanations on Menu 55, 56, 57, 58 and 59.

Example 1

Assuming the flow range in a specific pipe is from 0 ~ 1000 m^3/h, Mode "**4-20 mA**" is available by entering "0" in Window M56 and "1000" in Window M57 accordingly

Example 2

Assuming the flow range is from -1000 ~ 0 ~ 2000 m^3/h

A.) When flow direction is not considered, Mode "**20-4-20 mA**" is available by selecting Window M55, and entering "-1000" in Window M56 and "2000" in Window M57 accordingly

B.) When flow direction is considered, Mode "**0-4-20 mA**" is available. When the flow direction displays as negative, the current output is in range of 0-4 mA, whereas the 4-20 mA is for the positive direction. The output mode options are displayed in Window M55. Enter "-1000" in Window M56 and "2000" in Window M57

Calibrating and testing the current loop is performed in Window M58.

Complete the steps as follows: Press **Menu**, **5** , **8**, **ENTER** , move ∧or ∨ to display "0 mA", "4 mA", "8 mA", "16 mA", "20 mA" readings, connect an ammeter to test the current loop output and calculate the difference. Calibrate it if the difference is within tolerance.

Check the present current loop output in Window M59 as it changes along with change in flow.

5.10 How to Use the Flow Rate Frequency Output

DMTF provides a frequency output transmitter function. The high or low frequency output displayed indicates the high or low flow rate reading. The user can reset the frequency output and flow rate if required For example, if a pipe flow range is from 0 ~ 2000 m^3/h, the relative frequency output configuration is 10~1000Hz, and
The configuration procedure is as follows:

1.) In Window M68 (low limit frequency output flow value), input 0

2.) In Window M69 (high limit frequency output flow value), input 2000

3.) In Window M67 (Select frequency range), Press **ENTER**, input Low FO frequency 10, Press ∨, input 1000

NOTE

There is no output circuit specially assigned to frequency output. It only can be transmitted through OCT output. Select Item 13 ("13. FO") in Window M78 for details.

5.11 Totaliser Pulse Output

Wiring terminals are on Pulse F. Out, same as the Flow rate Frequency Output.

Example

Assuming to transmit out the positive totaliser pulse, and each pulse represents a flow of 0.1m^3, the configuration is as follows:

1.) In Window M32, select totaliser the flow unit "Cubic Meters (m^3)"

2.) In Window M33, select the scale factor "2. ×0.1"

3.) In Window M78, select "9. Positive int Pulse"

NOTE

Make sure to select a suitable totaliser pulse, because:

A.) The output may be extended if it is too large

B.) The relay may activate too frequently and may probably shorten its life if it is too small

C.) Furthermore, it may generate a pulse loss error if it operates too fast

D.) Therefore, a rate of 1 ~ 60 /minute is recommended

For these operations, refer to Window M32, M33, M34, M35, M36, M37, and M78.

5.12 How to Set the Date and Timer

Window M72 is available to set Date and Timer. Press **ENTER** key first and then input the new data and the new timer and finally press **ENTER** key to confirm

5.13 On/Off Flow Totalisers

1.) Window M34 is available to turn the net totaliser on and off

2.) Window M35 is available to turn the positive totaliser on and off

3.) Window M36 is available to turn the negative totaliser on and off

5.14 Measurement Unit Selections

1.) Window M30 is available to select Measurement units - Metric or English. Press **ENTER** key first and then scroll the ∧ or ∨ key to select the specific units, and finally press **ENTER** key to confirm

2.) Window M31 is available to select Flow rate units. Press **ENTER** key first and then scroll the ∧ or ∨ to select the specific units, and finally and finally press **ENTER** key to confirm

Refer to Part 4 - Windows Display Explanations for details.

5.15 LCD Backlit Options

Adjustment of the backlight is in window M70. Press **MENU**, **7** , **0** to enter M70 then press **ENTER** for modification, using ∧ or ∨ to scroll the menu until select the backlit options, and finally press **ENTER** key to confirm the change

5.16 Use Menu Windows for Transducer Mounting Inspection

5.16.1 Signal Strength

Signal strength (displayed in Window M90) indicates a detected strength of the signal both from upstream and downstream directions. The relevant signal strength is indicated by numbers from 00.0~99.9 in the DMTF. “00.0” represents no signal detected while “99.9” represents maximum signal strength.

Normally, the stronger the signal strength detected, the instrument will work more reliably, as well as the more stable the measurement value obtained.

Adjust the transducer to the best position and check to ensure that enough sonic coupling compound is applied adequately during installation in order to obtain the maximum signal strength. System normally requires signal strength over 60.0, which is detected from both upstream and downstream directions. If the signal strength detected is too low, the transducer installation position and the transducer mounting spacing need to be re-adjusted and the pipe need to be re-inspected. If necessary, change the mounting method into the Z method.

5.16.2 Signal Quality (Q Value)

Q value is short for Signal Quality (displayed in Window M90). It indicates the level of the signal detected. In the DMTF, Q value is indicated by numbers from 00~99. “00” represents the minimum signal detected while “99” represents the maximum. Normally, the transducer position need to be adjusted repeatedly and coupling compound application need to be checked frequently until the signal quality detected is as strong as possible.

5.16.3 Total Time and Delta Time

“Total Time and Delta Time”, which displays in Window M93, indicates the condition of the installation. The measurement calculations in the flow meter are based upon the two parameters.

Therefore, when “Delta Time” fluctuates widely, the flow and velocities fluctuate accordingly. This means that the signal quality detected is too poor. It may be the resulted of poor pipe installation conditions, inadequate transducer installation or incorrect parameter input. Generally, “Delta Time” fluctuation is less than ±20%. Only when the pipe diameter is too small or velocity is too low can the fluctuation be wider.

5.16.4 Transit Time Ratio

Transit Time Ratio indicates if the transducer mounting spacing is accurate. The normal transit time ratio is 100±3% if the installation is proper. Check it in Window M91.If the transit time ratio is over 100±3%, it is necessary to check:

1.) If the parameters (pipe outside diameter, wall thickness, pipe material, liner, and so on.) have been entered correctly

2.) If the transducer mounting spacing is in accordance with the display in Window M25

3.) If the transducer is mounted at the pipe’s centerline on the same diameter, or

4.) If the scale is too thick or the pipe mounting is distorted in shape, and so on

The best ratio value is 100.0%, closer to this value, better accuracy available, try to move one transducer, increase or decrease the transducer mounting spacing to get a better ratio value.

5.16.5 Warnings

1.) Pipe parameters entered must be accurate; otherwise the flow meter can not work properly

2.) During the installation, apply enough coupling compounds in order to stick the transducers on the outside of the pipe wall. When checking the signal strength and Q value, move the transducer slowly around the mounting site until the strongest signal and maximum Q value can be obtained. Make sure that the larger the pipe diameter, the more the transducer should be moved. Check to be sure the mounting spacing is in accordance with the display in

Window M25 and the transducer is mounted at the pipe's centerline on the same diameter. Pay special attention to these pipes that formed by steel rolls (pipe with seams), since such a pipe is always irregular. If the signal strength is always displayed as 0.00, it means there is no signal detected. Thus, it is necessary to check that the parameters (including all the pipe parameters) have been entered accurately. Check to be sure the transducer mounting method has been selected properly, the pipe is not worn-out, and the liner is not too thick. Make sure there is indeed fluid in the pipe or the transducer is not very close to a valve or elbow, and there are not too many air bubbles in the fluid, and so on. With the exception of these reasons, if there is still no signal detected, the measurement site has to be relocated

3.) Make sure that the flow meter can run properly with high reliability. The stronger the signal strength displayed, the higher the Q value obtained. The longer the flow meter runs accurately, the higher the reliability of the flow rates displayed. If there is interference from ambient electromagnetic waves or the signal detected is too poor, the flow value displayed is not reliable; consequently, the capability for reliable operation is reduced

4.) After the installation is complete, power on the instrument and check the result accordingly

Part 6 - Troubleshooting and Frequently Asked Questions

6.1 Troubleshooting

The DMTF series ultrasonic flow meter has advanced self-diagnostics functions and displays any errors in the upper right corner of the LCD screen via definite codes in a date/time order. Hardware error diagnostics are usually performed upon each power on. Some errors can be detected during normal operation. Undetectable errors caused by incorrect settings and unsuitable measurement conditions can be displayed accordingly. This function helps to detect the errors and determine causes quickly; thus, problems can be solved in a timely manner according to the solutions listed in the following tables.

Errors displayed in the DMTF are divided into two categories:

1.) Table 1 applies when errors displayed during self-diagnostics upon power on. "* F" may be displayed on the upper left corner of the screen after entering the measuring mode. When this occurs, it is necessary to power on for self-diagnostics once again to detect and solve possible errors using the table below. If a problem still exists, please contact the factory or the factory's local representative for assistance

2.) Table 2 applies when errors caused by incorrect settings during operations. Signals are detected and error codes are displayed in Window M08

Table 1 Self-diagnoses and Error Solutions upon Power on

LCD Display	Cause	Solution
Rom Parity Error	* System ROM illegal or error	* Contact the factory
Stored Data Error	* System stored data block error	* Power on again or contact the factory
SCPU Fatal Error!	* SCPU circuit fatal error	* Power on again or contact the factory
Timer Slow Error Timer Fast Error	* System clock error	* Contact the factory
CPU or IRQ Error	* CPU or IRQ problem	* Power on again

System RAM Error	* System RAM questionable	* Power on again or contact the factory
Time or Bat Error	* System date time chip error	* Power on again or contact the factory
No Display, Erratic or Abnormal Operation	* Bad wiring connection	* Check wiring connections
Stroke Key - No Response	*Keypad locked or bad plug connection	* Enter the unlock password if the keypad is locked

Table 2 Error Codes and Solutions during Operation

Code	M08 Display	Cause	Solution
*R	System Normal	* System normal	No errors
*J	SCPU Fatal Error	* Hardware defect	* Contact the factory
*I	Signal Not Detected	*Signal not detected *Spacing is not correct between the transducers or insignificant coupling compound applied to face of transducers * Transducers installed improperly * Scale is too thick * New pipe liner	* Attach transducer to the pipe and tighten it securely. Apply a plenty of coupling compound on transducer and pipe wall * Remove any rust, scale, or loose paint from the pipe surface. Clean it with a file * Check the initial parameter settings * Remove the scale or change the scaled pipe section. Normally, it is possible to change a measurement location. The instrument may run properly at a new site with less scale * Wait until liners solidified and saturated
*H	Low Signal Strength	* Low signal strength * Cause refers to	* Solution refers to above-mentioned solutions

		above-mentioned reasons	
*H	Poor Signal Quality	* Poor signal quality * All reasons are included in the above-mentioned causes	* Solution refers to above-mentioned solutions
*E	Current Loop over 20ma (No influence normally. Ignore it if no current output is being used.)	* 4-20 mA current loop over 120% * Improper settings to current loop output	* Check settings（refer to Window M56）and confirm if actual flow is too high
*Q	Frequency output over set value No influence normally. Ignore it if no frequency output is being used	* Frequency output over 120% * Improper settings to frequency output or actual flow are too high	* Check settings（refer to Window M66-M69）and confirm if the actual flow is too high
*F	Refer to Table 1.	* Error in self-diagnoses during power on. * Permanent hardware error.	* Power on again; resolve it by the method listed in Table 1. If it is still a problem, contact the factory. * Contact the factory.

6.2 Frequently Asked Questions (FAQs) and Answers

Q: New pipe, high quality material, and all installation requirements met: why still no signal detected?

A: Check pipe parameter settings, installation method and wiring connections. Confirm if the coupling compound is applied adequately, the pipe is full of liquid, transducer spacing agrees with the screen readings and the transducers are installed in the right direction.

Q: Old pipe with heavy scale inside, no signal or poor signal detected: how can it be resolved?

A: Check if the pipe is full of fluid. Try the Z method for transducer installation If the pipe is too close to a wall, or it is necessary to install the transducers on a vertical or inclined pipe with flow

upwards instead of on a horizontal pipe).Carefully select a good pipe section and fully clean it, apply a wide band of coupling compound on each transducer surface (bottom) and install the transducer properly. Slowly and slightly move each transducer with respect to each other around the installation point until the maximum signal is detected. Be careful that the new installation location is free of scale inside the pipe and that the pipe is concentric (not distorted) so that the sound waves do not bounce outside of the proposed area. For pipe with thick scale inside or outside, try to clean the scale off, if it is accessible from the inside. Note: Sometimes this method might not work and sound wave transmission is not possible because of the a layer of scale between the transducers and pipe inside wall.

Q: Why is there no current loop (CL) output?

A:

1.) Check to see if the desired current output mode is set in Window M55

2.) Check to see if the CL is powered off by "CL Off" settings. Open the electronics enclosure to inspect the hardware circuit

3.) Check to see if the a short-circuit terminal on 4-20 mA screw terminals

Q: Why is the CL output abnormal?

A:

1.) Check to see if the desired current output mode is set in Window M55

2.) Check to see if the maximum and minimum current values are set properly in Windows M56 and M57. Recalibrate CL and verify it in Window M49

Q: Why is the flow rate still displayed as zero while there is fluid obviously inside the pipe and a symbol of "R" displayed on the screen?

A: Check to see if "Set Zero" is carried out with fluid flowing inside the pipe *(Refer to Window M42. If it is confirmed, recover the factory default in Window M43.)*

Q: With a poor measurement site environment in the plant and the voltage and power supplies fluctuating widely, is the instrument really able to keep running 24 hours a day repeatedly without

stopping and last for several years under such conditions?

A: DMTF is designed to work with high reliability under such conditions. It is provided with an intelligent signal conditioning circuit and internal correction circuitry. It will work under strong interference conditions and is able to adjust itself with strong or weak sound waves. It will work in a wide band of voltage: 90 – 260 VAC or 8V ~ 36 VDC.

Q: Why is the pipe not full of liquid or no flow in pipe, but still displays an unstable or wrong reading?

A: Pipe must be full of liquid, if not, **ENTER** the menu window M29, setup a EMPTY PIPE Q VALUE less than normal Q value (pipe full of liquid), cut off abnormal reading, DMTF will display Zero reading.

Part 7 – Limited Warranty and Service

7.1 Limited Warranty and Disclaimer

Dynameters International Pty Ltd warrants to the end purchaser for a period of one year from the date of invoicing from our factory. All products including transmitters and transducers manufactured by it are free from defects in materials and workmanship. This warranty does not cover products that have been damaged due to abnormal operation, misapplication, abuse, lack of maintenance, or improper installation. Dynameters' obligation under this warranty is limited to the repair or replacement of a defective product, with no charge to the end purchaser, if the product is inspected by Dynameters and found to be defective. Repair or replacement is done at the head office of Dynameters which is located in Shanghai, China. A return goods authorization (RGA) number must be obtained from Dynameters before any product may be returned for warranty repair or replacement. The product must be thoroughly cleaned and any process chemicals must be removed before it will be accepted for return.

The purchaser must determine the applicability of the product for its desired application and evaluate all risks in connection therewith. Dynameters assumes no responsibility or liability for any omissions or errors in connection with the application of its products. Dynameters will under no circumstances be liable for any incidental, consequential, contingent or special damages or loss to any person or property arising from the failure of any product, component or accessory.

All expressed or implied warranties, including the implied warranty of merchantability and the implied warranty to carte for a particular purpose or application are expressly disclaimed and shall not apply to any products sold or service rendered by Dynameters.

The above warranty supersedes and is in lieu of all other warranties, either expressed or implied and all other obligations or liabilities. No distributor or representative has any authority to alter the terms of this warranty in any way.

7.2 General Terms and Service

The manufacturer offers instrument installation guide for our customers with no charge.

1.) For any hardware failure of the instrument, we recommend that our end purchasers send back the instrument to our factory for service, due to the fact that the instrument is made of microprocessors and it may be difficult to perform field maintenance. Before sending back the instrument, please try to contact our Service Department first to describe what the problem is

2.) For other operational problems, please contact our local distributor by telephone, facsimile or email. In most cases, problems can be solved immediately

3.) Although the manufacturer offers one year warranty for all products, the end purchasers have to be responsible for one-way transportation from the customer's site to the factory

4.) When returning equipment, it is necessary for end purchasers to contact Service Department first to obtain an RGA number for the authority and proper tracking the defective product and its prompt inspection and return. The RGA number must be noted on the outside of the package box

5.) In Australia and other countries except China, please contact the following office first for obtaining return goods authorization (RGA) number:

Microview Australia Trading Pty Ltd
38 John Street
Payneham, South Australia 5070
Phone / Fax: (+61) 8 8165 2608
sales@microviewaustralia.com.au
www.microviewaustralia.com.au

Attn.: RGA#